

42-Range Digital Meter

22-811

OWNER'S MANUAL — Please read before using this equipment.

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INTRODUCTION

Your RadioShack 42-Range Digital Meter is a portable, compact, auto-ranging, digital multimeter. It is ideally suited for field, lab, shop, and home applications. The multimeter provides precise measurements and is built to provide the highest possible reliability. The meter measures DC and AC voltage up to 600V, DC and AC current up to 10A, resistance up to 40M Ω , capacitance from 0.5nF to 40 μ F, and frequency from 10Hz to 4MHz. Its 3³/₄-digit digital display can display up to 4,000 units.

Important:

- Completely read this manual before you use this meter.
- If you are not familiar with meters and testing procedures, we suggest you read *Using Your Meter* (Cat. No. 62-2039, not supplied) before you use this meter.

Auto-Ranging with Manual-Ranging

Override — the meter automatically selects

a range when you measure voltage, current, resistance, capacitance, and frequency. You can also manually set the range when measuring values you know are within a certain range.

Diode Check Function — the meter safely checks semiconductor junctions for open, short, or normal.

Electric Field Detection — Lets you detect the presence of AC voltage.

Data Hold Function — the meter holds the displayed value, so you can see the reading even after you disconnect the probes.

Auto-Polarity Operation — protects your meter and gives valid measurements when you connect the leads in reverse polarity.

Auto Power Off — the meter turns itself off after about 30 minutes if you do not change any setting, helping conserve battery power.

UL Listed — your meter has passed the stringent safety tests required by Underwriters Laboratories.

Note: The UL mark does not indicate that this product has been evaluated by Underwriters Laboratories for the accuracy of its readings.

Latest IC and Display Technology — ensures reliability, accuracy, stability, and ease of operation.

Overload and Transient Protection — helps protect the meter from accidental overload in most ranges.

Note: Your multimeter requires one 9V battery (not supplied).

A WORD ABOUT SAFETY

We have taken every precaution in designing this meter to ensure that it is as safe as we can make it. But safe operation depends on you, the operator. We recommend that you follow these simple safety rules:

- Never apply voltages to the meter that exceed the limits given in the specifications. Never apply more than 600V DC and AC between the input jacks and ground.
- Use extreme caution when working with voltages above 100V. Always disconnect

power from the circuit you are measuring before you connect test leads to high-voltage points.

- Never connect the test leads to a source of voltage when you select the diode check, resistance measurement, capacitance measurement, continuity function, frequency function, and electric field detection function, or any of the current measurement functions.
- Always discharge any capacitors of the circuit under test before you attach test leads.
- Always turn off power and disconnect the test leads from the circuit you are testing before you replace the meter's battery or fuse.
- Never operate the meter unless its back cover and battery cover are in place and fully closed.
- This equipment is rated for installation category II (maximum 3600VA).
- Because many AC/DC sets have a potentially hot chassis, be sure the top of your workbench and the floor underneath it are made of non-conductive materials.

This meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary except as noted in this Owner's Manual. If the meter requires repair, do not try to adjust it yourself. Take it to your local RadioShack store.

WARNINGS:

- **Use extreme caution in the use of this device, improper use of this device can result in injury or death. Follow all safeguards suggested in this owner's manual, in addition to normal safety precautions, in dealing with electrical circuits. Do not use this device if you are unfamiliar with electrical circuits and testing procedures.**
- **Never try to probe with both test leads at the same time or hold both test leads in one hand.**
- **Use extreme care while using the meter to measure current and voltage in commercial electrical panels. Unlike a home AC outlet, a commercial electrical panel has**



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tremendous current surge potential. This is especially true for three-phase industrial electrical panels. A small spark from one of these panels can cause a plasma explosion and fire that can severely burn you. Do not hold the meter while using it.

- Always wear protective leather gloves, a face shield, and fireproof arm and upper body protection while using the meter to measure current and voltage in commercial electrical panels.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- To reduce the risk of fire or shock hazard, do not expose this product to rain or moisture.
- For indoor use only.

SPECIAL PANEL MARKINGS

For your safety, we have added special markings to the meter's panel to remind you of the measurement limitations.

600V \approx
400mA
MAX

The maximum voltage that this meter can measure is 600V DC and AC. The maximum current that this meter can measure at this jack is 400mA DC and AC.



Caution: Be extremely careful when making high-voltage measurements; DO NOT TOUCH TERMINALS OR PROBE ENDS.



Caution: Risk of electric shock! Refer to the complete operating instructions.



The meter is protected by double insulation.

CAT II

This equipment is rated for INSTALLATION CATEGORY II (3600VA max.).

500V
MAX

To avoid electrical shock or instrument damage, do not connect the common input terminal (– COM jack) to any source that exceeds 500 volts with respect to earth/ground.



+10A MAX
UNFUSED

The maximum current you can measure at this jack is 10 amps DC/AC. This jack is not fuse-protected.

SPECIFICATIONS

(Accuracies at 73.4°F (23°C) $\pm 5^\circ\text{C}$, <75% RH)

DC VOLTS (Maximum Measurement: 600V)

400mV	$\pm 0.5\%$ of Reading, ± 4 in Last Digit
4V to 40V	$\pm 0.8\%$ of Reading, ± 3 in Last Digit
400V	$\pm 0.8\%$ of Reading, ± 3 in Last Digit
600V	$\pm 1.0\%$ of Reading, ± 4 in Last Digit

AC VOLTS (Maximum Measurement: 600V at 50/60 Hz, Average Responds, RMS Calibrated, DC Coupled)

400mV	$\pm 0.8\%$ of Reading, ± 4 in Last Digit
4V	$\pm 0.5\%$ of Reading, ± 3 in Last Digit
40V to 400V	$\pm 1.0\%$ of Reading, ± 3 in Last Digit
600V	$\pm 1.2\%$ of Reading, ± 4 in Last Digit

DC CURRENT (Maximum Measurement: 10A)

400 μA	$\pm 0.8\%$ of Reading, ± 5 in Last Digit
4mA	$\pm 0.8\%$ of Reading, ± 3 in Last Digit
40mA	$\pm 1.0\%$ of Reading, ± 5 in Last Digit
400mA	$\pm 1.0\%$ of Reading, ± 3 in Last Digit
4A	$\pm 1.0\%$ of Reading, ± 5 in Last Digit
10A	$\pm 1.2\%$ of Reading, ± 5 in Last Digit

AC CURRENT (Average Responds, RMS Calibrated, 10A Maximum, DC Coupled)

400 μA	$\pm 1.0\%$ of Reading, ± 5 in Last Digit
4mA	$\pm 1.0\%$ of Reading, ± 3 in Last Digit
40mA	$\pm 1.2\%$ of Reading, ± 5 in Last Digit
400mA	$\pm 1.2\%$ of Reading, ± 3 in Last Digit
4A	$\pm 1.2\%$ of Reading, ± 5 in Last Digit
10A	$\pm 1.5\%$ of Reading, ± 5 in Last Digit

RESISTANCE

400 Ω	$\pm 0.8\%$ of Reading, ± 5 in Last Digit
4k Ω – 40k Ω – 400k Ω	$\pm 0.8\%$ of Reading, ± 3 in Last Digit
4.0M Ω	$\pm 1.0\%$ of Reading, ± 3 in Last Digit
40M Ω	$\pm 2.0\%$ of Reading, ± 5 in Last Digit

CAPACITANCE

4nF	$\pm 4.0\%$ of Reading, ± 40 in Last Digits
40nF	$\pm 4.0\%$ of Reading, ± 10 in Last Digits
400nF – 40 μF – 400 μF	$\pm 3.0\%$ of Reading, ± 4 in Last Digit

Note: Accuracy with film capacitor or better, specified from 9.5% of full scale to full scale except 4.0nF range from 0.5nF to full scale.

FREQUENCY (Frequency Range: 10Hz to 4MHz)

400Hz – 4k–40k–400kHz–4MHz	$\pm 0.1\%$ of Reading, ± 4 in Last Digit
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Sensitivity

400Hz–4k–40kHz	50 mVrms
400kHz	100 mVrms
4MHz	350 mVrms

DUTY CYCLE (10Hz to 100kHz)

10% – 90% (Square wave at +5V/–0V)
 ± 2 digits/kHz, ± 2 in last digit

Note: Duty Cycle accuracy is dependent upon input signal frequency.

DIODE MODE

Open Circuit Voltage	< 2.8Vdc
Test Current	1 mA Typical

CONTINUITY BEEPER

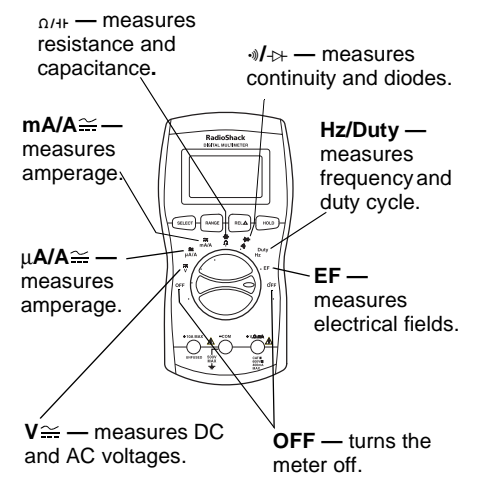
Continuity (short)	$\leq 50 \pm 30$ Ohms
Open	$> 50 \pm 30$ Ohms
Open Circuit	< 2.8 Volts
Short Circuit Current	< 2.0 mA
Beeper Volume (at 5cm)	65dB Min.
	(audio scale)

GENERAL

Maximum Common Mode Voltage	500VDC or RMS AC
Battery Life at 30 minutes use per day	About 200 days, Alkaline
Sleep Mode Timing	30 \pm 10 Minutes
Range Up Detect Value	Overflow (>4000 Counts)
Range Down Detect Value	380 Counts
Low Battery Indication	6.3V \pm 0.3 V
Sleep Mode Current	10 μA Normal, 20 μA Max.
Input Impedance	DCV/ACV: 10Mohm
Power Source	One 9V battery (not supplied)
Operating Temperature	41°F to 104°F (+ 5°C to + 40°C)
Storage Temperature	– 4°F to 140°F (– 20°C to + 60°C)
Humidity	Maximum Relative Humidity 80% for temperatures up to 87.8°F (31°C), decreasing linearity to 50% relative humidity at 104°F (40°C)
Dimensions (HWD)	6 ¹ / ₃ \times 3 ¹ / ₈ \times 1 ⁹ / ₁₆ Inches (161 mm \times 80 mm \times 39.5 mm)
Weight	Approx 6.8 oz (195 g)
Accessories	Fuse 500mA/250V 2 shrouded test leads red/black

Specifications are typical; individual units might vary. Specifications are subject to change and improvement without notice.

A QUICK LOOK AT YOUR METER



PREPARATION

INSTALLING A BATTERY

Your meter requires one 9-volt battery (not supplied) for power. For the best performance and longest life, we recommend a RadioShack alkaline battery.

WARNINGS:

- To avoid electrical shock, disconnect all of the meter's test leads from any equipment before you install or replace the meter's battery.
- Do not use your meter until the battery is properly installed and the battery cover is in place and secured.

Caution: Use only a fresh battery of the required size and recommended type.

- If the meter is on, rotate the function selector to **OFF** to turn it off. Then disconnect the test leads if they are connected.
- Use a Phillips screwdriver to loosen the battery cover's screw, then lift off the battery cover.
- Snap a fresh 9V battery onto the terminals of the battery clip in the battery compartment.
- Replace the battery cover and secure it with the screw.

When appears on the left side of the display or the meter stops operating properly, replace the battery.

Warning: Dispose of an old battery promptly and properly. Do not burn or bury it.

Caution: If you do not plan to use the meter for a month or more, remove the battery. Batteries can leak chemicals that can destroy electronic parts.

CONNECTING THE TEST LEADS

The test leads (black and red) supplied with your meter are rated for 1000 volts. Use only test leads of the same rating with the meter. You can order replacement leads from your local RadioShack store.

WARNING: ALTHOUGH THE TEST LEADS ARE RATED FOR 1000 VOLTS. THE MAXIMUM RATING OF THIS METER IS 600 VOLTS DC/600 VOLTS RMS AC. DO NOT TRY TO MEASURE VOLTAGE GREATER THAN 600 VOLTS DC/600 VOLTS RMS AC.

Plug the black test lead's right-angled end into **–COM** (common) on the front of the meter, then plug the red test lead's right-angled end into **+V.Ω.mA**. If you want to measure current higher than 400mA, plug the red test lead's right-angled end into **+10A MAX** instead of **+V.Ω.mA**.

Note: The meter sounds a warning tone when you set it to measure anything except current and you connect a test lead to **+10A MAX**. This reminds you not to touch the circuit with the test leads.

USING THE METER

Caution: When the meter is not in use, always leave the function selector set to **OFF**.

For the most accurate reading, the temperature should be between 65°F and 83°F (18°C and 28°C), with a maximum of 75% relative humidity.

TURNING THE METER ON/OFF/ TESTING THE DISPLAY

To turn on the meter, rotate the function selector to any function except **OFF**. To turn off the meter, rotate the function selector to **OFF**.

Note: If the function selector is not set to **OFF** and nothing appears on the display, the meter might be in its auto power shut-off mode. Press any button to turn on the meter. If the meter remains off, set the function selector to **OFF** and then set it to any function except **OFF**. If the meter still remains off, replace the battery (see "Installing a Battery" on Page 3).

To test the meter's display, turn off the meter, then hold down **HOLD** while turning on the meter. The meter turns on and all segments on the display appear. Release **HOLD** to turn off the test.

BEFORE YOU START

Follow these steps to familiarize yourself with the meter's operation before you use it for the first time.

Warning: Always turn off power to the circuit you are about to measure before you probe the test leads into high-voltage points.

Caution: Be sure to select the correct function before you touch the test leads to the circuit or component to be tested.

- Rotate the function selector to select one of the following functions, then repeatedly press **SELECT** to select the function you want.

Position	Description
V	1. Measures DC volts. 2. Measures AC volts.
μA/A	1. Measures amperage: <ul style="list-style-type: none">DC 0.4/4 mAAC 0.4/4 mA 2. Measures amperage: <ul style="list-style-type: none">DC 4/10 AAC 4/10 A
mA/A	1. Measures amperage: <ul style="list-style-type: none">DC 40/400 mAAC 40/400 mA 2. Measures amperage: <ul style="list-style-type: none">DC 4/10 AAC 4/10 A
Ω/Hz	1. Measures resistance. 2. Measures capacitance.
—/—	1. Checks continuity. 2. Checks diodes.
Hz/Duty	1. Measures frequency. 2. Measures duty cycle.
EF	Checks electrical fields.

For example, to measure a diode, rotate the function selector to then press **SELECT**. appears.

Your meter automatically enters the auto range mode when you turn on the meter. In the auto range mode, **AUTO** appears and the meter automatically selects the next higher or lower range (if available) when the measurement causes the display to overflow (the meter tries to display 4001 or more units) or underflow (the meter tries to display 379 or fewer units).

- If nothing appears on the display, press any button to turn on the meter.

- To select manual range mode, press **RANGE** while the meter is in auto-range mode. **AUTO** disappears.
- Repeatedly press **RANGE** to select different ranges. The decimal point shifts each time you press **RANGE**.
- Hold down **RANGE** for about 2 seconds, the meter exits manual range mode and returns to its auto range mode.
- Set the meter to the different measurement ranges. The unit of measure that appears on the display shows you the range that the meter is currently set to. For example, **mV** appears in the 400 mV range. Also, note the position of the decimal. For example, if **0.000 V** appears, the meter is set to measure less than 4 volts. If **000V** appears, the meter is set to measure up to 600 volts.

Read the range in volts, ohms, capacitance, or amps as indicated by the position of the decimal point.

Range	Display	Range	Display
400 mV	ddd.d mV	400 Ω	ddd.d Ω
4 V	d.ddd V	4 kΩ	d.ddd kΩ
40 V	dd.dd V	40 kΩ	dd.dd kΩ
400 V	ddd.d V	400 kΩ	ddd.d kΩ
600 V DC/AC	ddd V	4 MΩ	d.ddd MΩ
400 μA	ddd.d μA	40 MΩ	dd.dd MΩ
4 mA	d.ddd mA	4 nF	d.ddd nF
40 mA	dd.dd mA	40 nF	dd.dd nF
400 mA	ddd.d mA	400 nF	ddd.d nF
4 A	d.ddd A	4 μF	d.ddd μF
10 A	dd.dd A	40 μF	dd.dd μF

Note: The display might show a phantom reading in some DC and AC voltage ranges when the test leads are not connected to a circuit. This is normal. The high input sensitivity produces a “wandering” effect. When you connect the test leads to a circuit, a real measurement appears.

- Connect the test leads to the circuit you want to measure. To measure different circuits, see “Making Measurements” on Page 4.

Caution: If **0.F** (overflow) appears, the value you are measuring exceeds the range for the setting you selected. This is normal when you measure resistance or a diode, or do not have the leads connected to a component. If you are measuring voltage or current when **0.F** appears, however, immediately disconnect the probes from the circuit.

HOLDING A MEASUREMENT

Press **HOLD** to hold all indications on the display. **Hold** appears and the meter holds the measured value on the display even if you remove the probes from the circuit.

To cancel hold, press **HOLD** again or set the selector to another setting or press **SELECT**. **Hold** disappears.

USING RELATIVE MEASUREMENT

You can set the meter to have it not show an unwanted value that might appear as a result of internal or other factors. For example, the meter always shows a small value when you set the selector to Ω/H to measure capacitance, even when you have not connected the test leads to a component. (This happens because the meter measures its own internal capacitance, which is normal). If you set the meter in relative mode with the small value as reference, it does not display this value when you measure a component.

You can also set the meter to a baseline reference value. For example, if you are measuring resistors with a 100 ohm rating and you want to see the resistor’s tolerance (the actual value in ohms above or below the resistor’s rating), you can set the meter to a baseline reference value of 100 ohms so it displays only the resistor’s tolerance.

- Set the function selector to any setting except \rightarrow/\rightarrow , **Duty** function, or **EF**.
- Measure the zero offset (disconnect test leads for capacitance function, or touch the test leads together for other function) if you want to remove the zero offset from reading, or connect the test leads to the component whose measurement you want to use as a reference value.
- While measuring the zero offset or with the test leads connected to a component, hold down **REL**. **Rel** Δ appears. The meter is set to manual range mode.
- Use the meter to make a measurement.

Notes:

- If the reference value you measured in Step 2 is greater than the value of the measurement you made in Step 4, the meter shows a negative value. This is not a malfunction.
- 0.F** appears if you measure values outside of the meter’s currently set range.
- The meter displays values greater than 4000 counts as long as the range used is not an overflow range. (A count is the smallest unit of measure that the meter can measure). For example, if you store

–3.500 volts as a reference, then measure +3.500 volts, the meter might display 7.000 volts.

- You can not set **0.F** as a reference value.

To reset a relative measurement, press **REL** Δ again or set the function selector to another setting.

AUTOMATIC POWER OFF

Your meter conserves power by automatically turning off about 30 minutes after the last time you changed a setting (even if you are making measurements).

To turn the meter back on after it automatically turns off, press any button.

USING POWER LOCK

To set the meter so it does not turn off automatically, set the function selector to **OFF** to turn it off. Hold down **HOLD** and **SELECT** at the same time, then turn on the meter. **PLoc** appears until you release **HOLD** and **SELECT**. The meter sets itself to its normal test mode and does not automatically turn itself off.

To reset the meter so it automatically turns itself off, turn off the meter then turn it back on. The meter automatically turns itself off after about 30 minutes.

MAKING MEASUREMENTS

MEASURING DC/AC VOLTAGE WARNINGS:

- Never clamp a test lead to a hot wire (usually red, black, or blue in AC wiring circuits). If one lead is clamped to a hot wire and you touch the meter’s other probe, you could receive an electric shock.
- The maximum input limit for voltage measurement is 600 V DC/AC (RMS). To avoid electrical shock and damage to the meter, never try to measure a DC voltage above 600 volts or an AC voltage above 600 volts RMS.

- Rotate the function selector to **V** \approx .
- Repeatedly press **SELECT** to select the function between DC voltage and AC voltage (\sim appears on the left side of the display for AC voltage measurement).
- If the meter is set to automatic range control, the meter automatically moves to the range that gives the best reading.
- To set manual range control, press **RANGE** then change the range (if necessary) by repeatedly pressing **RANGE**.

5. Touch the probes to the circuit you want to test.

When you measure DC voltage, – appears on the left side of the display if you touched the black probe to a point in the circuit that has a higher voltage potential than the point where you connect the red probe.

Notes:

- In the 400 V and 400mV ranges, the decimal point appears in the same position (one place to the left). To distinguish between the two ranges, **mV** appears in the 400mV range and **V** appears in the 400 V range.
- If the meter is set to the 400mV DC manual range and you measure an over-range input, **0.F** continues to appear even after you remove the input. This is not a malfunction. If this happens, touch the test leads together or change the meter's setting to clear it.

Measuring AC Voltage Riding On a DC Source Bias

WARNING: To avoid injury or damage to your meter, never try to measure an AC voltage that is riding on a DC source bias where the peak AC voltage exceeds 100 V with respect to earth ground.

1. Rotate the function selector to **V_~**. The meter automatically selects auto range and the DC measurement mode.
2. Measure the DC voltage to ensure that it does not exceed 100V.
3. Press **SELECT** to select the AC mode. **~** appears.
4. Turn off the power of the circuit under test.
5. Connect the black test lead to the circuit's neutral or ground lead.
6. Connect a 0.1 microfarad/100V mylar capacitor in series with the positive terminal of the voltage source and the red probe.
7. Apply the power to the circuit. The display shows the AC voltage.

Warning: To avoid electrical shock, do not touch the test probes, capacitor, or the circuit under test while applying power.

8. When you finish measuring the AC voltage, turn off the power of the circuit under test, then disconnect the capacitor you connected in Step 6.

Measuring Three-Phase AC Voltage

Your multimeter is designed primarily to measure household AC voltages. If you want to measure 3-phase, line-to-line voltage, please note the following:

- Because of the dangers inherent in measuring three-phase circuit, we strongly recommend you do not use this meter for such applications.
- The actual voltage can be greater than the circuit's rated line-to-ground voltage.

Most 3-phase power circuits are rated by their line-to-line voltage. This voltage is higher than the line (or phase) to ground voltage. To determine if a line-to-line 3-phase voltage exceeds the rating of this meter, multiply the rated line-to-ground voltage by 1.732 (the square root of 3). For example, if the rated line-to-ground voltage is 400 volts, the line-to-line voltage is $400 \times 1.732 = 692.8$ V AC.

WARNING: This voltage exceeds the meter's rating. Therefore, you should not connect the meter to this circuit or to any equipment connected to the circuit. Doing so could present a dangerous shock hazard to you, and could also damage the meter.

MEASURING DC/AC CURRENT

To measure AC or DC current, you must break the circuit and connect the test leads to two circuit connection points. The connection must be in series with the circuit under test.

WARNING: Do not apply voltage directly across terminals. You must connect the meter in series with the circuit.

Cautions:

- Never connect the test leads across a voltage source. Doing so can damage the meter or the circuit under test. The maximum input limit for AC/DC current measurement is 10A.
- If you do not know the amount of current in the circuit you are measuring, always connect the red test lead to **+10A MAX**.

1. Rotate the function selector to **μA/ A_~** for 0.4/4mA and 4/10A ranges or **mA/ A_~** for 40/400mA and 4/10A ranges.
2. Repeatedly press **SELECT** to set the meter to measure AC current (**~** appears) or DC current (**~** disappears).
3. Remove the power from the circuit under test and discharge all capacitors.
4. Plug the black test lead into **–COM** and the red test lead into the appropriate jack.

5. Connect the meter's test leads in series with the circuit.
6. Apply power and read the current.

If the measurement is less than 400mA, connect the red test lead to **+ 10A MAX**, and proceed to Step 7.

If the measurement is greater than 400mA, connect the red test lead to **+ 10A MAX**, take the reading now, and do not follow the remaining steps.

7. Remove power from the circuit.
8. Move the red test lead to **+ V.Ω.mA**.
9. Rotate the function selector to **μA/ A_~** for 0.4/4mA or **mA/ A_~** for 40/400mA.
10. Reapply power to the circuit.

If the measured current's polarity is negative, – appears before the value.

Notes:

- If your measurement exceeds the currently selected range, **0.F** appears until the measured voltage or current is reduced to a value below the currently selected range.
- **+ V.Ω.mA** is fuse-protected. If the meter does not show a reading in the 0.4/4mA range or 40/400mA ranges, check the fuse (see "Replacing the Fuse" on Page 7).

MEASURING RESISTANCE

The resistance measuring circuit in your meter compares the voltage gained through a known resistance (internal) with the voltage developed across an unknown resistance.

WARNING: Be sure the circuit under test has all power removed and any associated capacitors are fully discharged before you make a resistance measurement.

Caution: Your meter has a circuit to protect the resistance range from over-voltage. However, to avoid accidentally exceeding the protection circuit's rating and to ensure a correct measurement, never connect the test leads to a source of voltage while the function selector is set to **Ω/Hz**.

1. Remove all power from the circuit under test and discharge all capacitors.
2. Rotate the function selector to **Ω/Hz**.

Caution: Never connect the test leads to a source of voltage while the rotary function selector is set to **Ω/Hz**.

3. Repeatedly press **SELECT** until **Ω, KΩ, or MΩ** appears to set the meter to measure resistance.

Note: With no resistance connected across the test leads (meaning resistance is infinite), **OL** appears when you set the meter to measure resistance. This is normal.

4. Touch the test leads across the circuit you want to measure, or remove one of the leads of the component you want to measure from its circuit and touch the test leads across the component. If the meter is set to automatic range control, it automatically moves to the proper range.

If you set the meter to use manual range, repeatedly press **RANGE** to set manual-range control and change the range (if necessary).

Notes:

- If you are measuring resistance of about 1M Ω or more, the display might take a few seconds to stabilize. This is normal.
- As with the voltage range, use the measuring units that appear on the display to determine the current resistance range. If only Ω appears, the values of the measurements are in ohms. If **k** and Ω appear, the meter is measuring kilohms (1 kilohm = 1000 Ω). If **M** and Ω appear, the meter is measuring megohms (1 megohm = 1,000,000 Ω).

Hint: If you want to accurately measure a very small resistance, you can view the resistance of the meter's test leads, then subtract that resistance from the measured value. To measure the meter's internal resistance, simply touch the end of the test leads together. The meter selects the 400 Ω scale and displays its internal resistance. You can also use the meter's relative function to do this (see "Using Relative Measurement" on Page 4).

MEASURING CAPACITANCE

The capacitance measuring circuit in your meter charges a connected capacitor to a specific voltage level, then discharges the capacitor to a lower voltage. The meter measures the amount of time takes to discharge the capacitor.

Caution: Do not connect the test leads to a source of voltage with the function selector set to Ω/Hz . This could damage the meter or the circuit being tested.

1. Remove all power from the circuit under test and discharge all capacitors.
2. Rotate the function selector to Ω/Hz .
3. Set the meter to measure capacitance by repeatedly pressing **SELECT** until **nF** or μF appears.

4. Attach the red test lead to the positive side of the capacitor and attach the black test lead to the negative side of the capacitor. Or remove one of the leads of the capacitor you want to measure from its circuit and connect the test leads to the capacitor.

Note: Electrolytic capacitors have positive and negative terminals. Be sure to connect each test lead to the correct terminal to match the polarity of these capacitors.

5. Read the measured value on the display.

Notes:

- The voltage applied across electrolytic capacitors will affect their measured values. That is, a measurement taken with a low voltage will be different and lower than that taken with a voltage that approaches the capacitor's voltage rating. Since this meter cannot use high voltage to set the electrolyte. It cannot measure the absolute value of capacitance.
- Low-value capacitors might match or be close to the actual input capacitance of your meter. To measure low capacitance values, use the meter's relative feature to adjust the meter for the meter's own capacitance (see "Using Relative Measurement" on Page 4).
- The accuracy of capacitance measurement depends on the measurement method and also differs with different types of capacitors. The meter's measurement is for reference only.

CHECKING CONTINUITY

Caution: Do not connect the test leads to a source of voltage with the selector set to Ω/Hz . This could damage the meter or the circuit being tested.

You can use the meter to check for shorted or open electrical circuits.

1. Remove all power from the circuit under test and discharge all capacitors.
2. Rotate the function selector to Ω/Hz .
3. To select the continuity function, repeatedly press **SELECT** until Ω/Hz appears at the top of the display.
4. Touch the test leads across the circuit you want to measure. **Shrt** appears and the buzzer sounds if the circuit resistance is less than about 50 ohms (meaning the circuit is continuous or shorted). **Open** appears and the meter's buzzer does not sound if the circuit resistance is greater than about 50

ohms (meaning the circuit is not continuous).

CHECKING DIODES

This procedure lets you check diodes, transistors, and other semiconductors for opens, shorts, and normal operation. It also lets you determine the forward voltage and polarity for diodes. (This is handy when you need to match a diode). You can also check LEDs using this procedure.

Caution: Do not connect the test leads to a source of voltage with the function selector set to Ω/Hz . This could damage the meter or the circuit being tested.

1. Remove all power from the circuit under test and discharge all capacitors.
2. Rotate the function selector to Ω/Hz .
3. To select the diode function, repeatedly press **SELECT** until \rightarrow appears on the top of the display.
4. Connect the test leads to the device you want to check, or remove one of the leads of the component you want to measure from its circuit and connect the test leads to the component. Note the first reading.
5. Reverse the test leads and note the second reading.

If one reading shows a value and the other is overrange (**OL** appears) the device is good. If **OL** appears during both readings, the device is open. If both values are very small or zero, the device is shorted.

Notes:

- When you test a silicon-type semiconductor, the values might vary depending on the temperature.
- The values that appear during a diode check show the actual forward voltage (2.0V max). If the voltage exceeds 2.0V, **OL** appears. This means the diode check cannot be made using this meter.

Checking Diode Polarity

Many diodes have a stripe or mark on one side. The marked side of the diode indicates the diode's cathode or negative (–) side. The other side is the anode or positive (+) side.

If a diode is not marked, you can use your meter to check the diode's polarity. As you follow the steps under "Checking Diodes" on Page 6, connect the red test lead to one side, connect the black test lead to the other side, then measure and note the voltage. Then reverse the test leads and measure and note the second reading. The side of the diode where the meter shows a higher voltage using the red test lead is the anode (+) side.

MEASURING FREQUENCY/DUTY CYCLE

The meter can measure frequency from 10 Hz to 4 MHz and a duty cycle with a signal frequency from 10 Hz to 100 kHz. The amplitude of a signal is not larger than 10V peak.

1. Rotate the function selector to **Hz/Duty**.
2. To select the frequency function, repeatedly press **SELECT** until **Hz**, **kHz**, or **MHz** appears.
3. Press **RANGE** to manually select the range, then repeatedly press **RANGE** until the desired range appears.
4. To select the duty cycle function, repeatedly press **SELECT** until % appears.
5. Connect the black test probe to a ground reference for the signal, and connect the red test probe to the signal source.

MEASURING AN ELECTRIC FIELD

You can use this feature to detect the presence of AC voltage in places such as an AC power cord. This lets you easily detect a break in an electric circuit or locate the source of an electric field.

Note: Varying construction materials and methods give unreliable results for measuring an electric field behind a wall. Do not attempt to measure voltage on in-wall or other premises wiring.

1. Rotate the function selector to **EF**.
2. Remove the test leads.
3. Hold the meter so the built-in antenna (inside the top of the meter) is near the object you wish to examine. Do not touch the meter to the object being tested.

Note: For the best sensitivity, hold the meter behind the function selector.

If the meter detects an electrical field, 1 to 5 bars appear on the display (corresponding to the strength of the field), and the meter buzzes. **EF** appears but no bars appear if the electrical field is weak.

CARE

Keep the meter dry; if it gets wet, wipe it dry immediately. Use and store the meter only in normal temperature environments. Handle the meter carefully; do not drop it. Keep the meter away from dust and dirt.

Modifying or tampering with the meter's internal components can cause a malfunction and might invalidate its warranty. If your meter is not performing as it should, take it to your local RadioShack store for assistance.

CLEANING

To keep the meter looking new, occasionally wipe it with a cloth lightly dampened with water. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.

WARNINGS:

- Do not let any water drip inside the meter while cleaning it.
- Make sure that the meter is completely dry before using it.

REPLACING THE FUSE

If the meter does not work, you might need to replace the fuse with the spare fuse we have included with your meter. The spare fuse is inserted into plastic holder on the top cabinet near the terminals.

The fuse is a 500mA, 250V ceramic fuse (Cat. No. 27-1070).

Caution: Do not use a fuse with ratings other than those specified here. Doing so might damage your meter.

1. If the meter is on, rotate the function selector to **OFF** to turn it off. Then disconnect the test leads if they are connected.

WARNING: To avoid electric shock, you must disconnect the test leads before you remove the battery cover and back cover.

2. Use a Phillips screwdriver to loosen the battery cover's screw, then lift off the battery cover.
3. Remove the battery.
4. Use a Phillips screwdriver to loosen the screws in the back cover and lift off the cover.

Caution: The battery line connects the back cover and the top cabinet together. Do not try to remove the back cover.

5. To remove the fuse, gently pull the red ribbon holding it. The fuse pops out.

6. If the fuse is blown, discard it and save the ribbon. Then remove the spare fuse from the plastic holder and insert it into the fuse holder through the loop of the attached ribbon.
7. Replace the back cover and secure it with the screws.
8. Install the battery (see "Installing a Battery" on Page 3).
9. Replace the battery cover and secure it with the screw.

WARNING: Do not operate your meter until the back cover is in place and secured.

Limited Ninety-Day Warranty

This product is warranted by RadioShack against manufacturing defects in material and workmanship under normal use for ninety (90) days from the date of purchase from RadioShack company-owned stores and authorized RadioShack franchisees and dealers. EXCEPT AS PROVIDED HEREIN, RadioShack MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN. EXCEPT AS PROVIDED HEREIN, RadioShack SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED DIRECTLY OR INDIRECTLY BY USE OR PERFORMANCE OF THE PRODUCT OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES RESULTING FROM INCONVENIENCE, LOSS OF TIME, DATA, PROPERTY, REVENUE, OR PROFIT OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF RadioShack HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

In the event of a product defect during the warranty period, take the product and the RadioShack sales receipt as proof of purchase date to any RadioShack store. RadioShack will, at its option, unless otherwise provided by law: (a) correct the defect by product repair without charge for parts and labor; (b) replace the product with one of the same or similar design; or (c) refund the purchase price. All replaced parts and products, and products on which a refund is made, become the property of RadioShack. New or reconditioned parts and products may be used in the performance of warranty service. Repaired or replaced parts and products are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the product made after the expiration of the warranty period.

This warranty does not cover: (a) damage or failure caused by or attributable to acts of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation or maintenance, alteration, lightning or other incidence of excess voltage or current; (b) any repairs other than those provided by a RadioShack Authorized Service Facility; (c) consumables such as fuses or batteries; (d) cosmetic damage; (e) transportation, shipping or insurance costs; or (f) costs of product removal, installation, set-up service adjustment or reinstallation.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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